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(12) **EUROPEAN PATENT APPLICATION**

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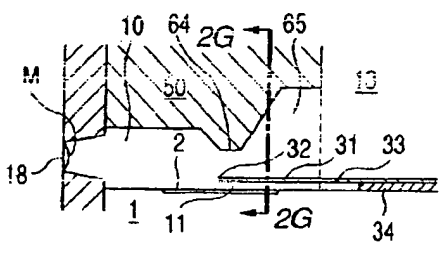
<p>(84) Designated Contracting States:  <b>AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE</b>                  Designated Extension States:  <b>AL LT LV MK RO SI</b></p> <p>(30) Priority: 21.08.1998 JP 23611798                  21.08.1998 JP 23612098                  21.08.1998 JP 23612298                  21.08.1998 JP 23612398                  21.08.1998 JP 23612498                  21.08.1998 JP 23612598                  21.08.1998 JP 23612698</p> <p>(71) Applicant: <b>CANON KABUSHIKI KAISHA</b>  <b>Tokyo (JP)</b></p>	<p>(72) Inventors:                  • Shimazu, Satoshi                  Ohta-ku, Tokyo (JP)                  • Sugama, Sadayuki                  Ohta-ku, Tokyo (JP)                  • Ishinaga, Hiroyuki                  Ohta-ku, Tokyo (JP)                  • Taneya, Yoichi                  Ohta-ku, Tokyo (JP)                  • Sugiyama, Hiroyuki                  Ohta-ku, Tokyo (JP)</p> <p>(74) Representative:  <b>Beresford, Keith Denis Lewis et al</b>  <b>BERESFORD &amp; Co.</b>                  High Holborn                  2-5 Warwick Court                  London WC1R 5DJ (GB)</p>
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(54) **Liquid discharge head, liquid discharge method and liquid discharge apparatus**

(57) A liquid discharge head comprises heating members for generating thermal energy to create bubbles in liquid, discharge ports forming the portions to discharge the liquid, liquid flow paths communicated with the discharge ports, at the same time, having bubble generation areas for enabling liquid to create bubbles, movable members arranged in the bubble generation areas to be displaced along with the development of the bubbles, and regulating members to regulate the displacement of each of the movable members within a desired range, and with energy at the time of bubble creation, the liquid being discharged from the discharge

ports. For this liquid discharge head, each of the liquid flow paths holds bubbles at the time of bubbling, at the same time, being provided with gaps arranged on the sides of the movable member to allow the liquid on the upstream thereof to flow into the bubble generation area at the time of bubble disappearing. With the structure thus arranged, the meniscus is drawn into the liquid flow path quickly immediately after the bubble disappearing of bubble begins, and then, with a strong force of the meniscus, the trailing portion of the liquid column connected with the discharged droplet is cut off outside the discharge port, hence making the number of satellites smaller for the enhancement of the quality of prints.

**FIG. 1A**



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FIG. 1B

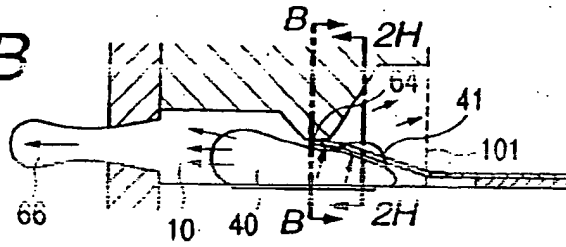


FIG. 1C

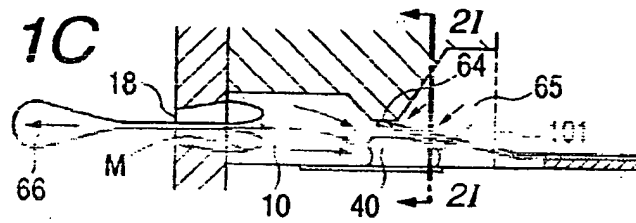


FIG. 1D

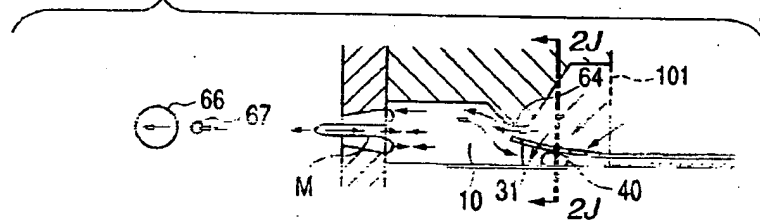


FIG. 1E

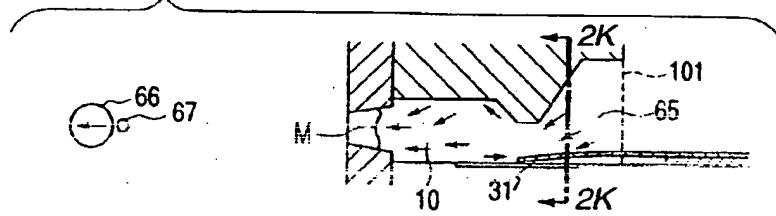
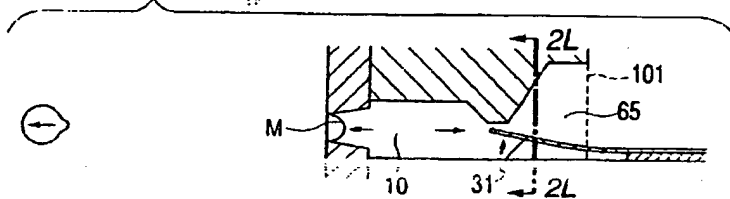


FIG. 1F





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## EUROPEAN SEARCH REPORT

Application Number

EP 99 30 6611

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Y	EP 0 721 841 A (CANON KK) 17 July 1996 (1996-07-17)	20, 29-31, 43,70, 75,81	B41J2/14 B41J2/055
A	* page 11, line 1 - page 12, line 10 * * figures 10-12 * ---	1,11,59, 66	
Y	EP 0 819 530 A (CANON KK) 21 January 1998 (1998-01-21)	20, 29-31, 43,51, 70,75,81	
A	* column 20, line 31 - column 21, line 52 * * column 22, line 45 - column 23, line 20 * * figures 8,10 * ---	1,11,59, 66	
Y	EP 0 816 087 A (CANON KK) 7 January 1998 (1998-01-07)	51	
A	* column 16, line 30 - column 17, line 50 *  * column 19, line 25 - column 22, line 22 * * figures 4,6 * ---	1,11,20, 29-31, 43,59, 66,70, 75,81	TECHNICAL FIELDS SEARCHED (Int.Cl.7) B41J
A	EP 0 811 492 A (CANON KK) 10 December 1997 (1997-12-10)  * page 26, line 2 - line 45 * * page 27, line 38 - page 28, line 10 * * figures 31,34 * --- -/--	1,11,20, 29-31, 43,51, 59,66, 70,75,81	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 July 2000	Examiner Didenot, B
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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## EUROPEAN SEARCH REPORT

Application Number  
EP 99 30 6611

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 739 734 A (CANON KK) 30 October 1996 (1996-10-30)  * page 11, line 13 - line 49 * * figure 10 *	1,11,20, 29-31, 43,51, 59,66, 70,75,81	
D,A	EP 0 436 047 A (SIEMENS AG) 10 July 1991 (1991-07-10) * the whole document *		
D,A	US 5 278 585 A (KARZ ROBERT S ET AL) 11 January 1994 (1994-01-11) * the whole document *		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
The present search report has been drawn up for all claims			
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CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

EPO FORM 1503 03.82 (Pct01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 30 6611

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06-07-2000

Patent document cited in search report		Publication date <sup>1</sup>	Patent family member(s)	Publication date
EP 0721841	A	17-07-1996	AU 4092296 A	08-08-1996
			AU 4092396 A	08-08-1996
			AU 4092596 A	08-08-1996
			AU 6481398 A	02-07-1998
			AU 6481598 A	02-07-1998
			AU 6481698 A	25-06-1998
			CA 2167142 A	14-07-1996
			CA 2167143 A	14-07-1996
			CA 2167150 A	14-07-1996
			CN 1136498 A	27-11-1996
			CN 1136499 A	27-11-1996
			CN 1136500 A	27-11-1996
			EP 0721842 A	17-07-1996
			EP 0721843 A	17-07-1996
			JP 9201966 A	05-08-1997
			JP 9048127 A	18-02-1997
			JP 9070972 A	18-03-1997
			KR 197927 B	15-06-1999
			SG 42311 A	15-08-1997
			SG 42312 A	15-08-1997
			SG 42313 A	15-08-1997
			AU 706168 B	10-06-1999
			AU 5089496 A	07-11-1996
			CA 2175167 A	27-10-1996
			CN 1145304 A	19-03-1997
			EP 0739738 A	30-10-1996
			JP 9048128 A	18-02-1997
EP 0819530	A	21-01-1998	JP 10024574 A	27-01-1998
EP 0816087	A	07-01-1998	JP 10076655 A	24-03-1998
EP 0811492	A	10-12-1997	JP 10052912 A	24-02-1998
			AU 2474497 A	22-01-1998
			CA 2207206 A	07-12-1997
			US 5943074 A	24-08-1999
EP 0739734	A	30-10-1996	AU 712741 B	18-11-1999
			AU 5089596 A	07-11-1996
			CA 2175166 A	27-10-1996
			CN 1135968 A	20-11-1996
			JP 9011471 A	14-01-1997
			KR 190746 B	01-06-1999
			SG 49942 A	15-06-1998
			US 6007187 A	28-12-1999
			AU 4092596 A	08-08-1996

EPO FORM P0459

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 30 6611

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The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-07-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0739734 A		AU 6481598 A	02-07-1998
		CA 2167142 A	14-07-1996
		CN 1136498 A	27-11-1996
		EP 0721842 A	17-07-1996
		JP 9201966 A	05-08-1997
		SG 42313 A	15-08-1997
EP 0436047 A	10-07-1991	NONE	
US 5278585 A	11-01-1994	JP 6031918 A	08-02-1994

EPO FORM P0459

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